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Economical Solar-Heating or Cooling System With New Solar-Energy Concentrators

The problem:

Solar-energy collectors are commonly equipped with tracking mechanisms. The mechanisms turn the collectors to face the Sun as it changes its position in the sky. This provides maximum collector exposure to the available solar energy. Unfortunately, the tracking mechanisms are expensive and require frequent maintenance.

The solution:

An economical solar-energy collector, or concentrator, has been proposed which does not require a tracking mechanism. The concentrator forms a part of an inexpensive solar-heating or cooling system.

How it's done:

The solar-energy concentrator is made from an array of cylindrical Fresnel lenses. Beneath the lenses

are heat-collector elements. As the Sun changes its angular position, the lenses focus the solar energy on different collector elements. The Sun is thus in continuous focus without mechanical tracking.

The basic concentrator module is shown in Figure 1. It includes a Fresnel lens made of plastic with the flat planar surface facing the Sun. The bottom part of the lens is multifaceted. Each facet acts as a small prism which concentrates solar energy on one of the heat-collector elements. Therefore, as the Sun changes its position, different heat collectors come into focus to receive solar energy.

With a collector element in focus, fluid (e.g., water, ethylene glycol, or other suitable liquid) located in a channel underneath is heated. When the proper temperature is reached, the fluid is released through a thermostatically controlled valve. (The valve may be connected so as to release one or several channels

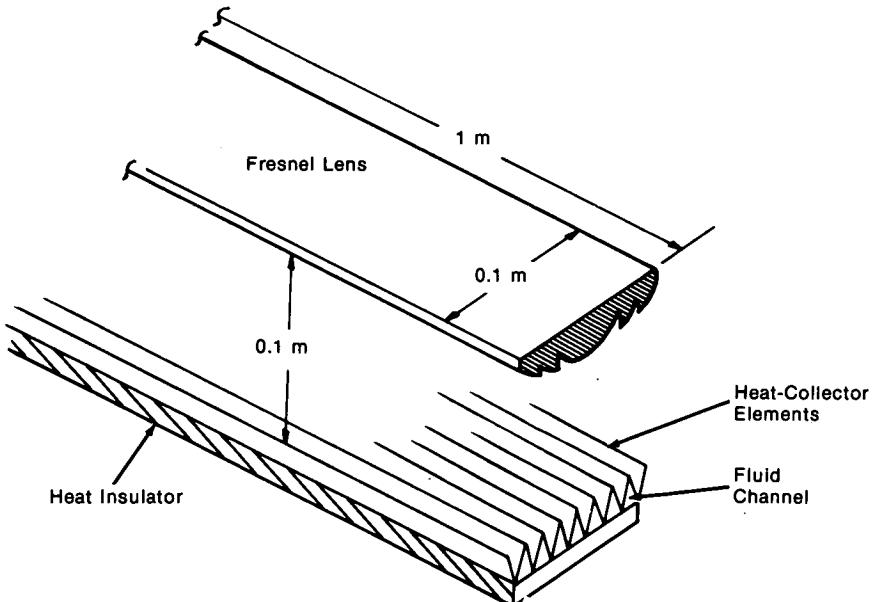


Figure 1. Concentrator Module

(continued overleaf)

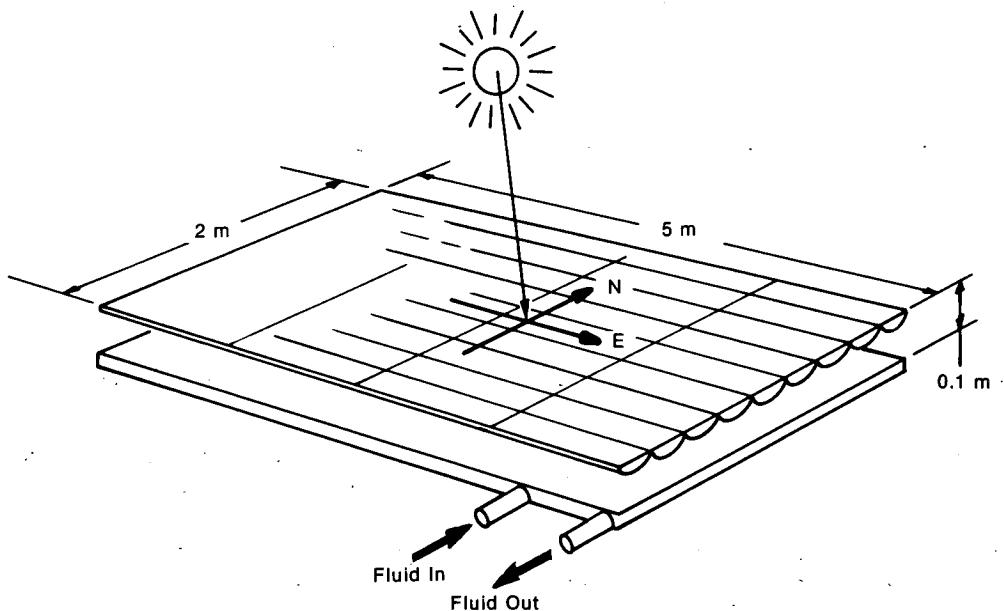


Figure 2. 10-kW Solar-Heating System

illuminated by the Sun.) This process continues for 8 hours a day in the winter and approximately 13 hours per day during the summer in an area where solar energy is abundant, heating one collector after another in sequence.

An assembled 10-kW solar-heating system in which 100 concentrator modules are used is shown in Figure 2. This system is positioned in an east-west direction running parallel to the length of the Fresnel lenses. Operating at 50 percent efficiency, the system is estimated to produce 35 kW-h/day. The present operating system cost is estimated at \$0.05/kW-h.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
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4800 Oak Grove Drive
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Reference: TSP75-10182

Patent status:

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